3. HK CHALLENGES OF GREEN BUILDING

MAJOR HK CHALLENGES OF GREEN BUILDING

•MATERIAL FLOW

•ENERGY WITH LOW CARBON EMISSIONS

•INDOOR ENVIRONMENTAL QUALITY

•DENSITY

• IMPACTS AT URBAN SCALE

•COST AND BENEFIT ANALISYS . LIFE CYCLE COST

•USE OF LOCAL RENEWABLE SOURCES OF ENERGY

MAIN PROBLEMS TO ADDRESS

HEAT ISLAND EFFECT AND CLIMATE CHANGE

VISUAL POLLUTION

EXCESS OF WATER RUN FF

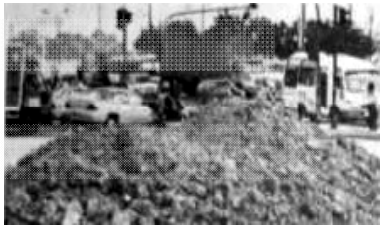
DESTRUCTION OF BIODIVERSITY

DESTRUCTION OF NATURAL HABITAT

NOISE

WATER POLLUTION

AIR POLLUTION



EXESS OF CONSTRUCTION DEBRIS

4. HK GREEN BUILDING, WHERE TO GO?

CONCLUSIONS

- COLABORATIVE APPROACH BETWEEN DIFFERENT CERTIFICATION TOOLS
- FOSTERING CHINA – HK EXPERIENCES
- LEARNING FROM OTHER LATITUDES
- THINK GLOBAL, ACT LOCAL (POLICIES)
- ACADEMIA-PUBLIC SECTOR-PRIVATE SECTOR
- FROM LABELS TO CRITERIA
- DEVELOPMENT OF FEASIBLE TECHNOLOGIES

4. HK GREEN BUILDING, WHERE TO GO?

5. RESEARCH ACTIVITIES AND PROJECTS

Sustainable practices

- Renewable Energy
- Daylight & Sunlight
- Natural Ventilation
- Double Skin Façade (DSF)
- Green Wall & Green Roof

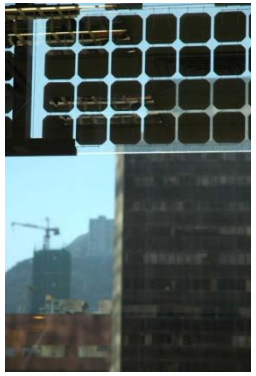
Building Integrated Photovoltaic (BIPV) system

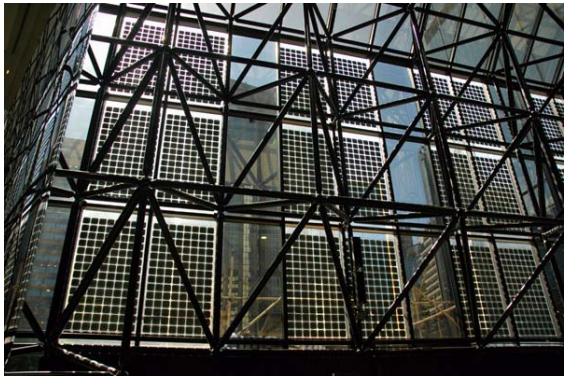
Design

Photovoltaic panels to the windows block the sun

3 Sub systems:

- Support sub-system: from the complex composition of crystalline photovoltaic panels, installed on rooftops of buildings;
- Sunshades sub-system: double-glazed photovoltaic panels and equipped with built-in single-crystal photovoltaic cells. These photovoltaic panels installed on the external walls of buildings, for one floor to floor, all 12 windows on the south half of the sun to provide shelter; and
- Skylight sub-system: double-glazed photovoltaic panels and equipped with built-in single-crystal photovoltaic cells. These vertical panels installed on the main entrance lobby to replace some of the existing glass atrium glass wall.





http://www.chamber.org.hk/Chinese/The_Bulletin/2004_Bulletin/dec_2004/solar.asp

Renewable Energy- Wind Energy

Wind Turbine
Prevailing Wind
(Noise Problem)

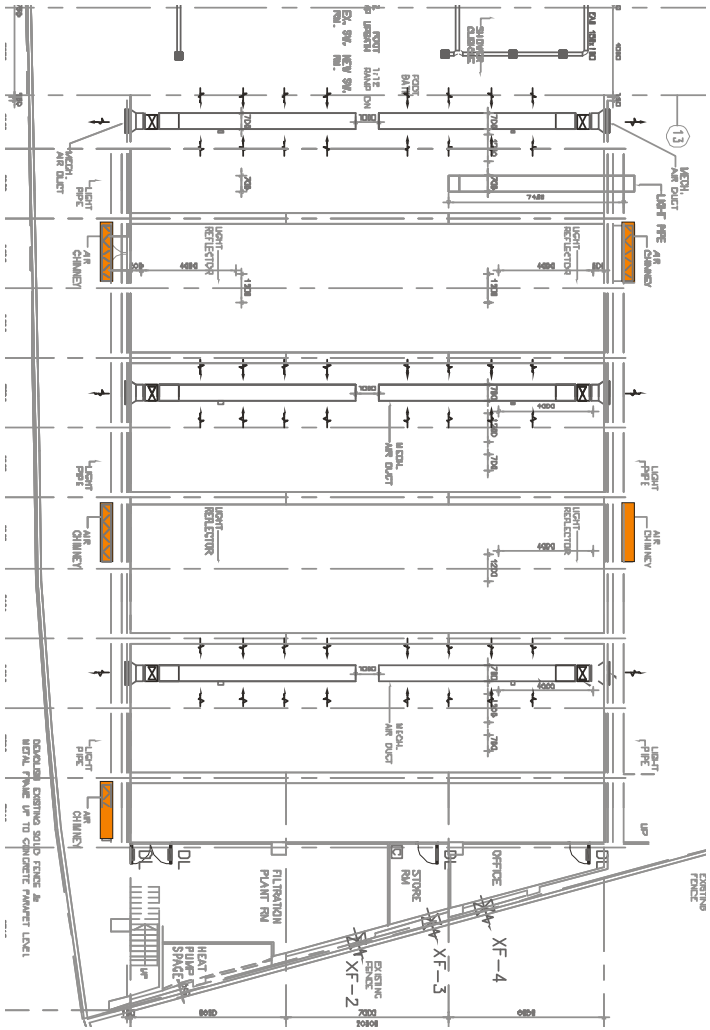
Micro Wind Power Turbines for UK Office Building

The BBC reports that an miniature urban wind farm is being built on top of a 13-storey building in Manchester city centre using micro wind turbines.

The 24 turbines, which will stand 3m tall, will be erected on top of the CIS building on Portland Street.

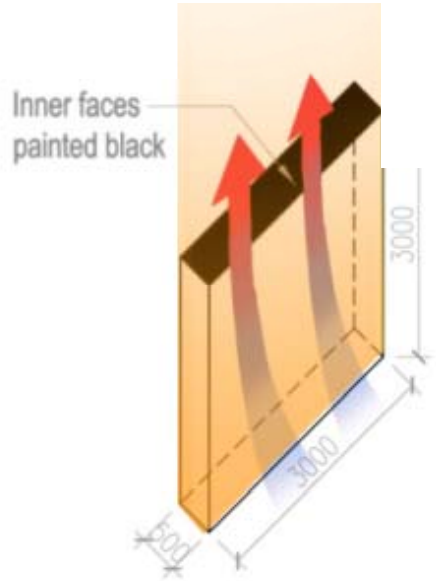
The turbines will produce 56,000 units of renewable energy each year, enough electricity to service about 5% of the energy needs of the building.

Natural Ventilation



Solar Chimney

Five Solar chimney will be installed in order to regulate temperature and bring away water vapor. The efficiency of which was investigated during the CFD Study. Natural ventilation is achieved with minimal assisted mechanical ventilation using pendant fans with temperature sensors as control device.



Natural Ventilation

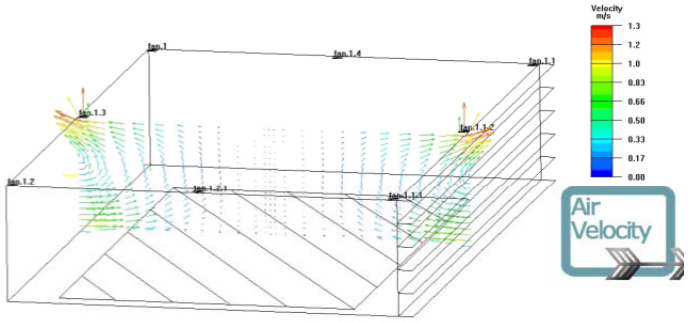


Fig.9 Air velocity vector in a middle plane in case 3

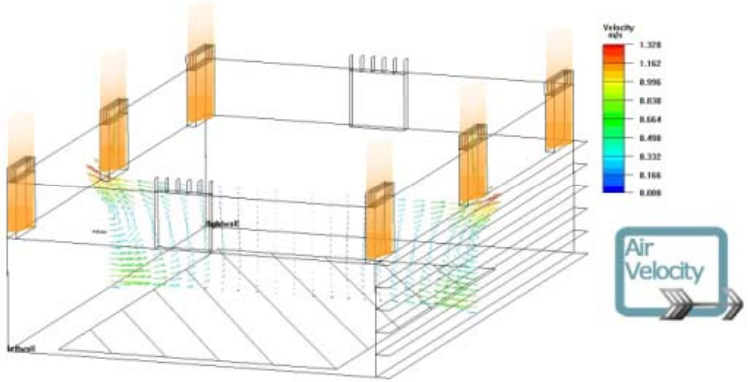


Fig.12 Air velocity vector in a middle plane in case 4

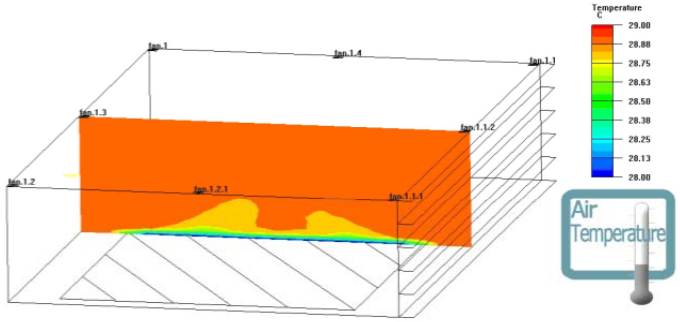


Fig.11 Air temperature distribution in a middle plane in case 3

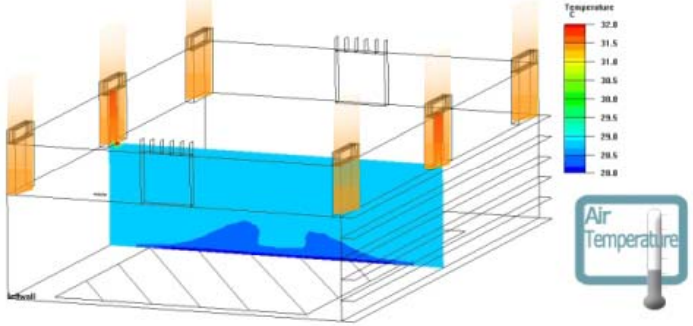


Fig.13 Air temperature distribution in a middle plane in case 4

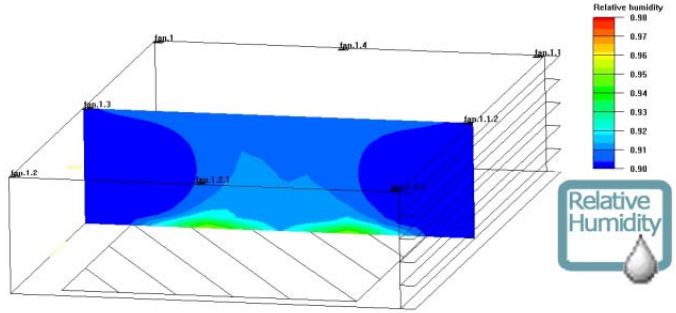


Fig.10 Relative humidity distribution in a middle plane in case 3

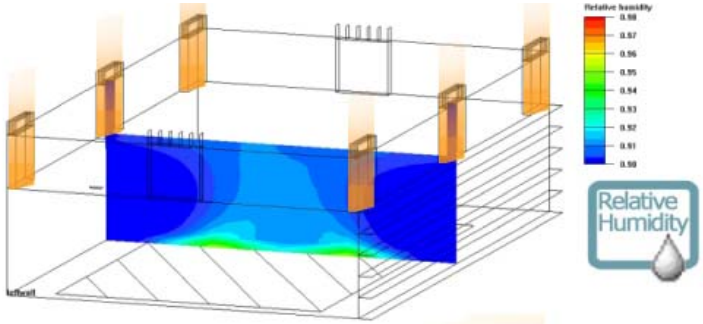
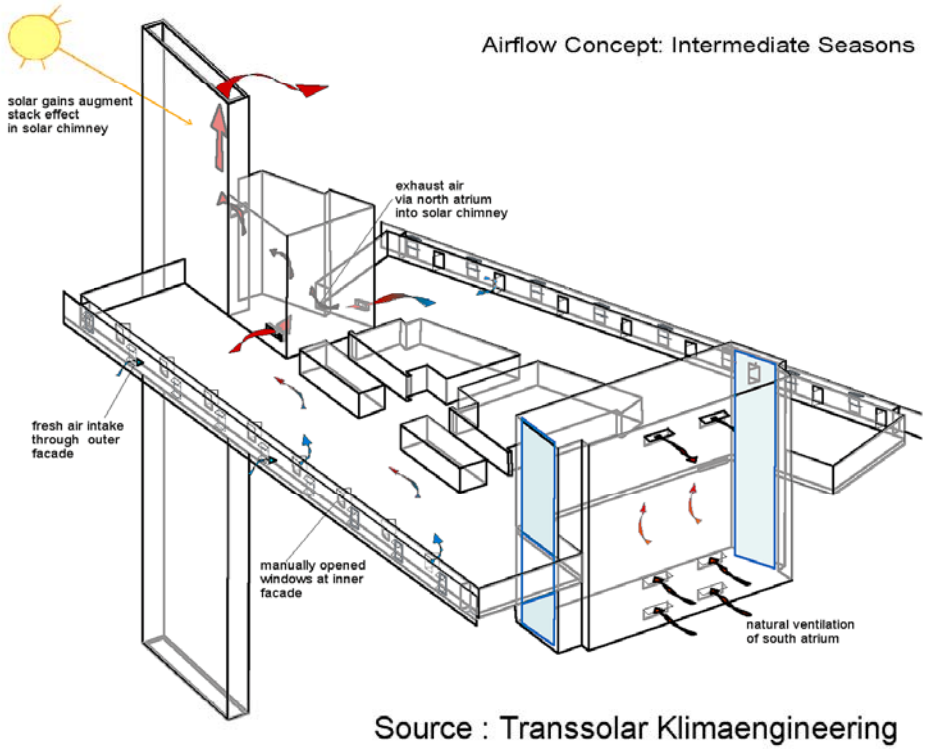


Fig.15 Relative humidity distribution in a middle plane in case 4

Double Skin Facade

Examples

Manitoba Hydro Headquarters Building
Winnipeg, Manitoba



Source : Transsolar Klimaengineering

A translucent double curtain wall façade provides a high performance envelope that reduces heating and cooling loads by providing a buffer to extreme outdoor temperatures. Operable windows in the inner wall add to natural ventilation at seasonally appropriate times of the year.

http://www.aeieng.com/services/sustainable/projects/manitobasustainable.htm

DSF Examples

Gemeinnützige Siedlungs-und Wohnbaugenossenschaft mBH (GSW) Headquarters, Berlin, Germany

West double skin façade

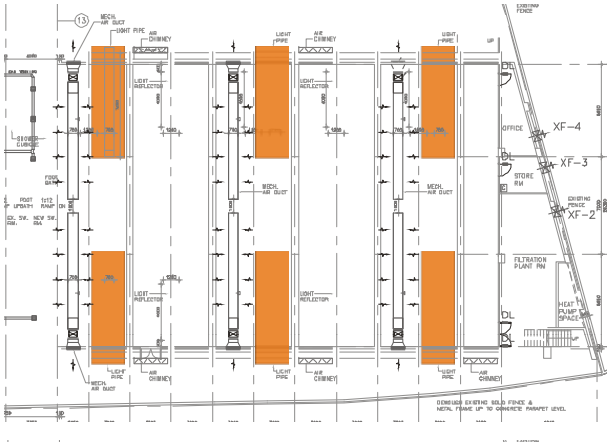
East triple-glazed façade

The east façade consists of automatically and manually-operated triple-glazed windows with between-pane blinds. Louvered metal panels also occur on the east façade to admit fresh air independently from the windows.

The west façade consists of a double-skin façade with interior double pane windows that are operated both manually and automatically and a sealed 10-mm exterior glazing layer. The interstitial space is 0.9 m wide. Wide, vertical, perforated aluminum louvers located in this interstitial space are also automatically deployed and manually adjustable. The louvers can be fully extended to shade the entire west façade.

Source: http://gaia.lbl.gov/hpbf/perfor_c.htm

Daylighting: Anidolic Light Pipe



Daylight illuminance (lux) distributions in the Swimming Pool at water surface level
(calculated using RADIANCE based on CIE Overcast Sky
with unobstructed horizontal illuminance 10 klux)

2250	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
1744	1402	2016	2016	1744	1402	2016	2016	1744	1402	1744
1209	1111	1391	1391	1209	1111	1391	1391	1209	1111	1209
647	628	824	824	647	628	824	824	647	628	647
357	359	490	490	357	359	490	490	357	359	357
205	214	298	298	205	214	298	298	205	214	205
129	155	193	193	129	155	193	193	129	155	129
118	184	130	130	118	184	130	130	118	184	118
76	266	94	94	76	266	94	94	76	266	76
50	213	71	71	50	213	71	71	50	213	50
35	153	57	57	35	153	57	57	35	153	35
35	153	57	57	35	153	57	57	35	153	35
50	213	71	71	50	213	71	71	50	213	50
76	266	94	94	76	266	94	94	76	266	76
118	184	130	130	118	184	130	130	118	184	118
129	155	193	193	129	155	193	193	129	155	129
205	214	298	298	205	214	298	298	205	214	205
357	359	490	490	357	359	490	490	357	359	357
647	628	824	824	647	628	824	824	647	628	647
1209	1111	1391	1391	1209	1111	1391	1391	1209	1111	1209
1744	1402	2016	2016	1744	1402	2016	2016	1744	1402	1744

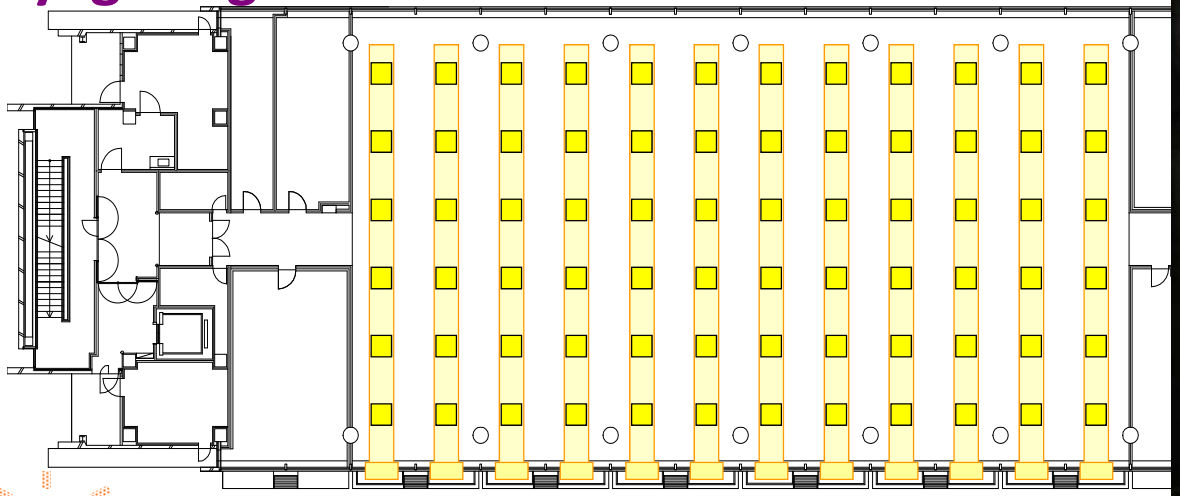
5000 / 2000 / 3000 / 3000 / 2000 / 5000

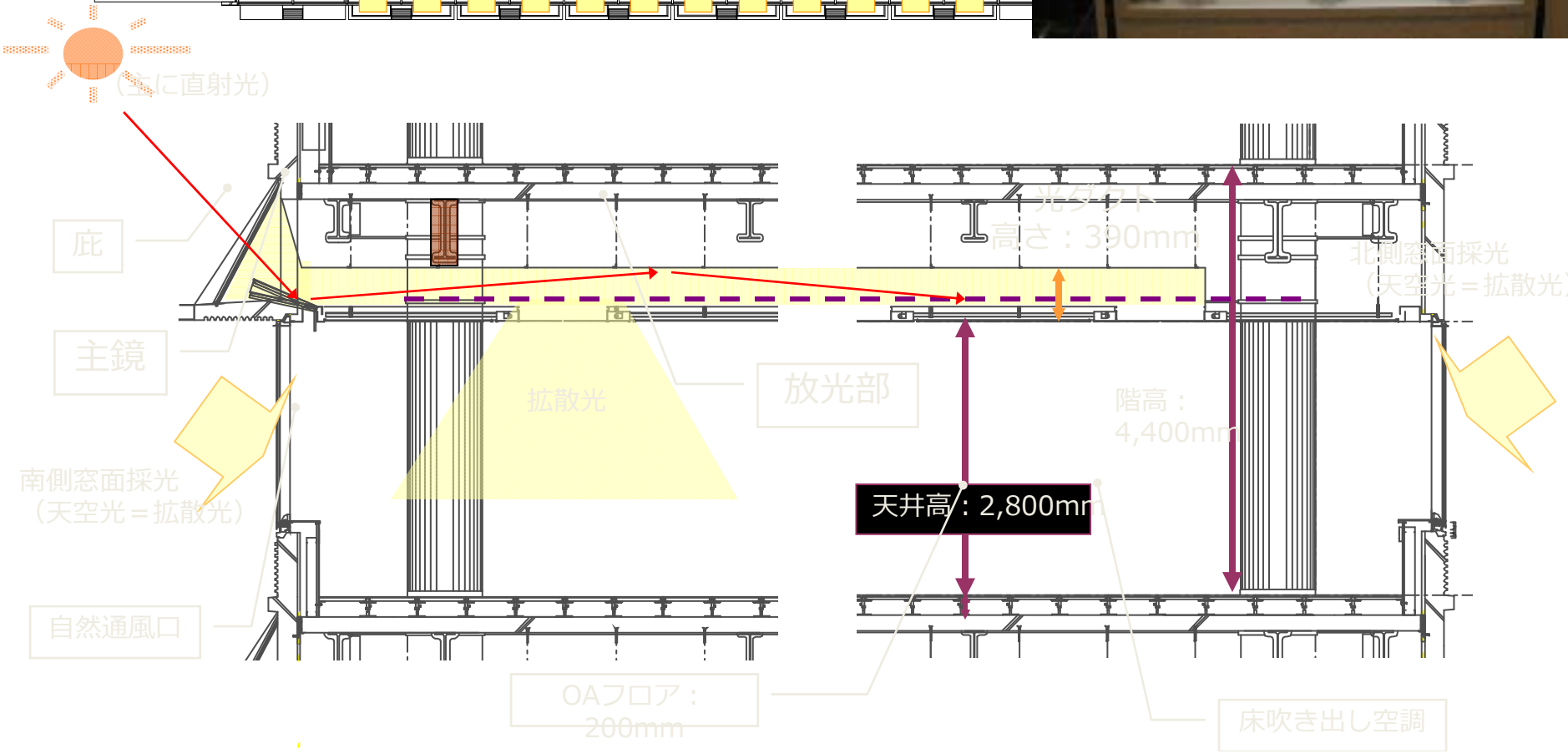
Anidolic Light pipe

Note:
The Government requirement of the minimum illuminance at water surface level is 200 lux

Legend
- < 100 lux
- 100 - 200 lux
- > 200 lux

Daylighting: Mirror Duct





Green Roof & Green Wall

Benefits of green roof / wall

Environmental –

- Improve roof capacity of Rainwater retention
- Mitigate Urban heat island
- Promote Biodiversity

Energy-

- Improve energy efficiency by acting as an insulating layer and reducing heat flux through roof
- Roof durability by protecting roofs from climate changes

Social-

- Promote health and well being
- Enhance productivity of employees
- Increasing property value

Ford Rouge River Manufacturing Complex extensive sedum roof, Michigan USA, by McDonough + Partners

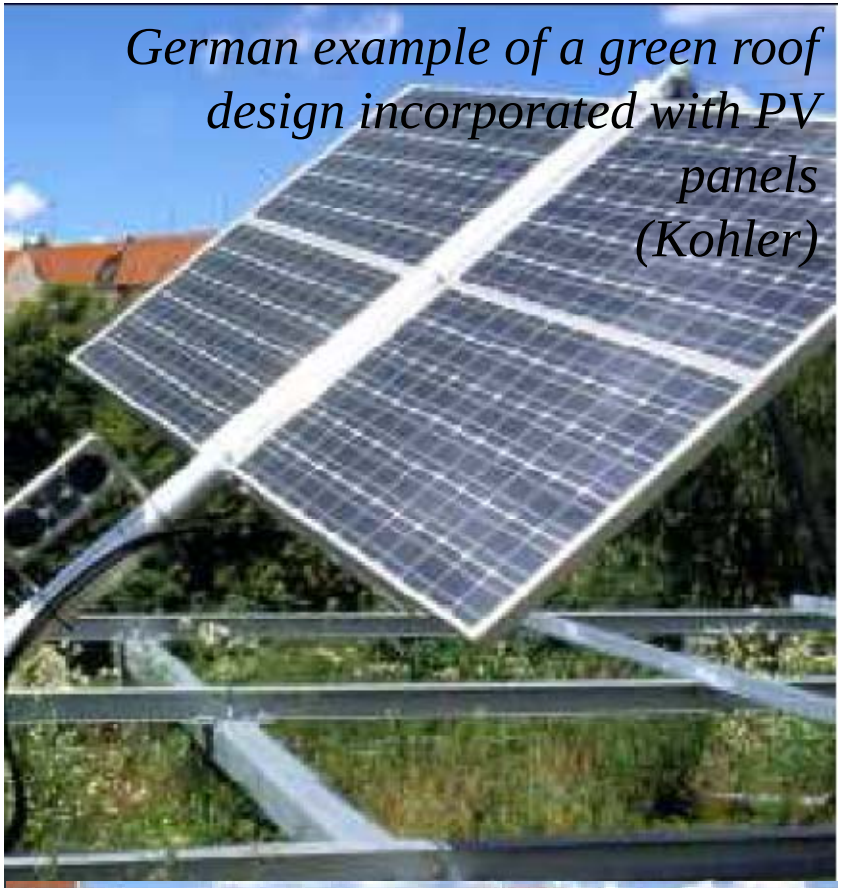
Mitsui Sumitomo Insurance Surugadai Building intensive roof garden, Tokyo

Green Roof / Wall

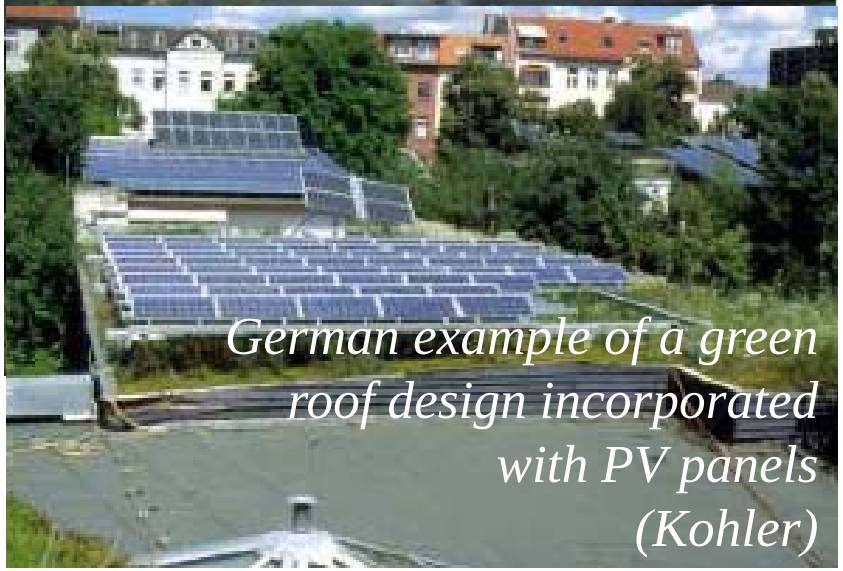
Design guidelines

- Green roof design could incorporate PV panel
- There is a positive interaction between two sustainable technologies-

  Green roofs reduce operation temperature of the PV system, thus increasing efficiency and energy yield PV array offers shading for green roof, thus improving growth of plants and increasing number of species.



German example of a green roof design incorporated with PV panels (Kohler)

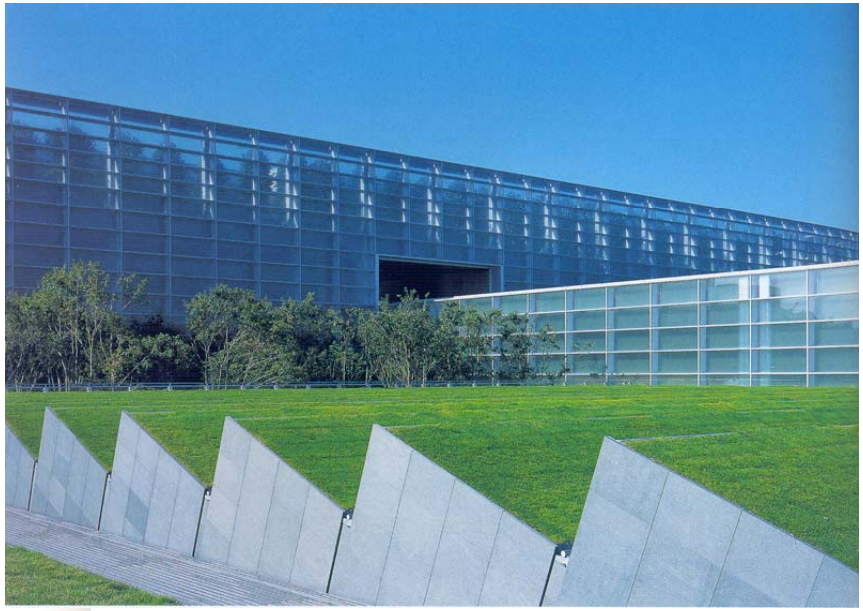


German example of a green roof design incorporated with PV panels (Kohler)

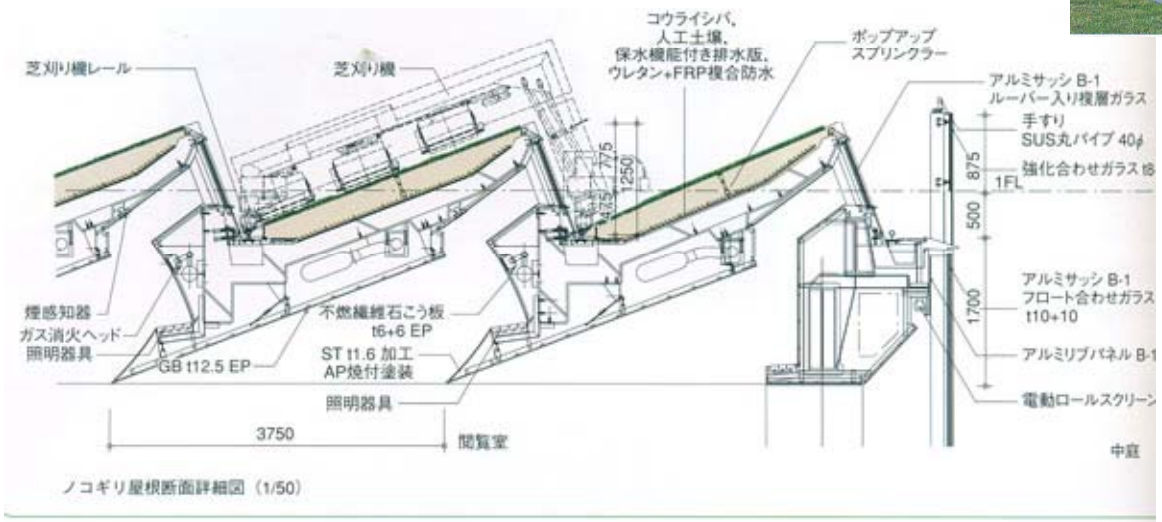
Green Roof / Wall

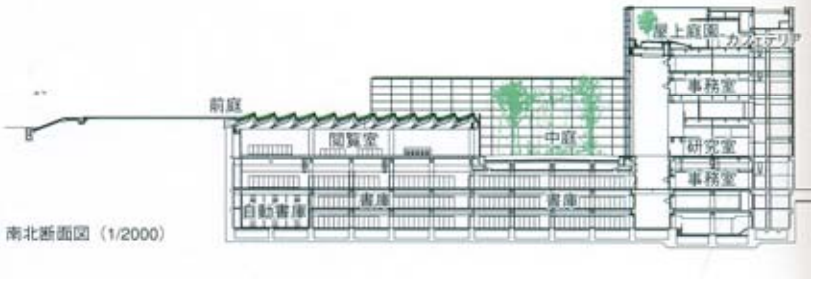
Design guidelines

- Skylight design is a good idea for a wide-span green roof with the spaces underneath used for exhibition/library purpose.



Japan example of a green roof design incorporated skylight (Nikken)





Green Roof / Wall

Marché des Halles in Avignon

Musée du Quai Branly in Paris

Source: www.georgehernandez.com

Green Roof / Wall

Caixa Forum, Madrid, Spain

Living Walls, Netherlands

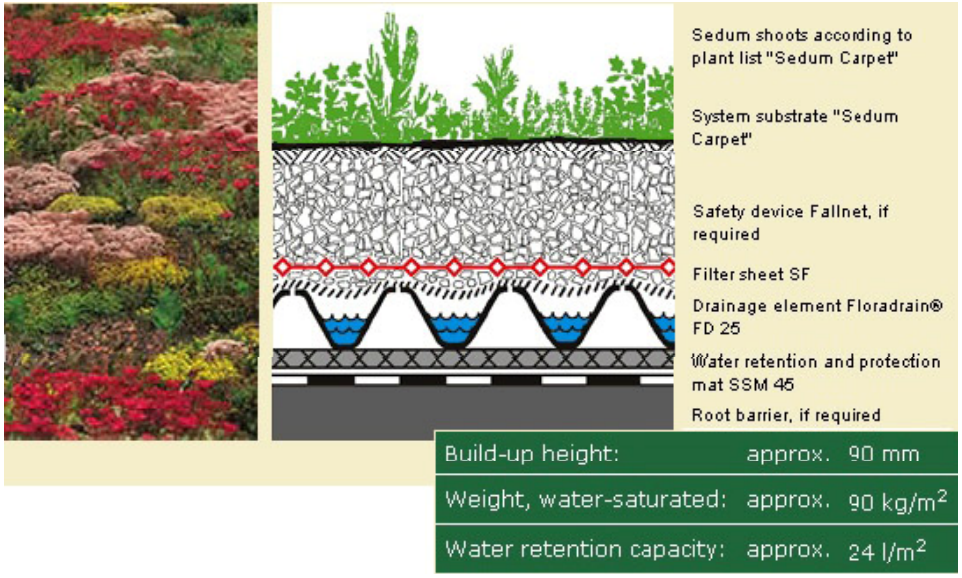
Source:www.environmentalgraffiti.com

Green Roof / Wall

Design guidelines

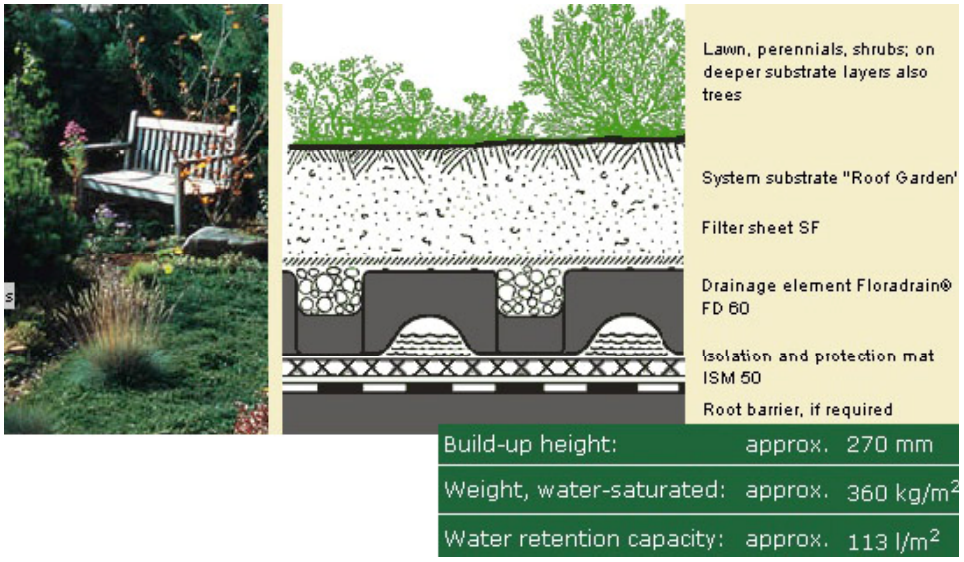
The structure design should take into account the load of the green roof ingredients- mainly the growing substrate:

80-150kg/M² *for an extensive green roof (10-15CM growing medium, planted with sedum grass, generally inaccessible)*



Extensive Green roof system

250-400kg/M² *for an intensive green roof (25-40 CM growing medium, planted with shrubs or trees, accessible).*

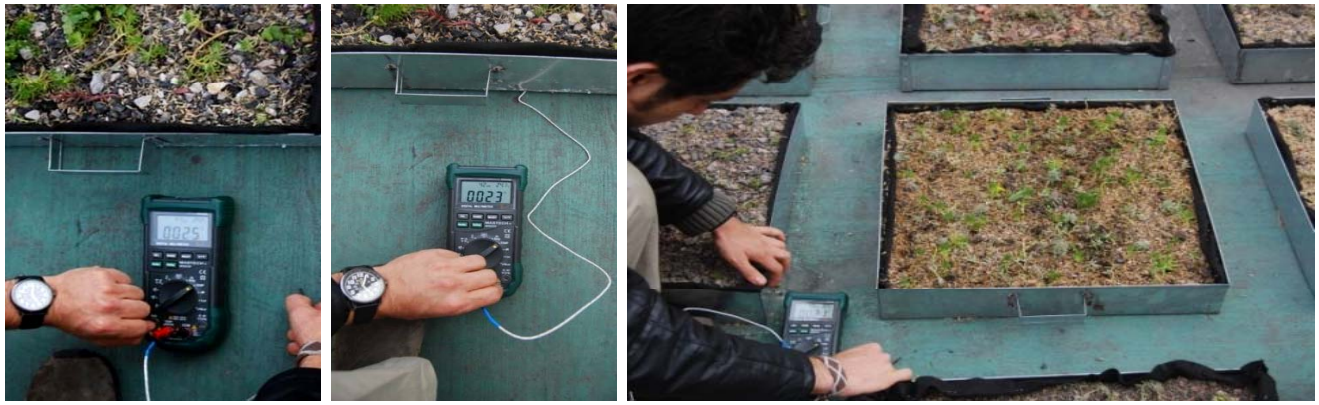


Intensive Green roof system

Zinco Green roof system

Green Roof / Wall

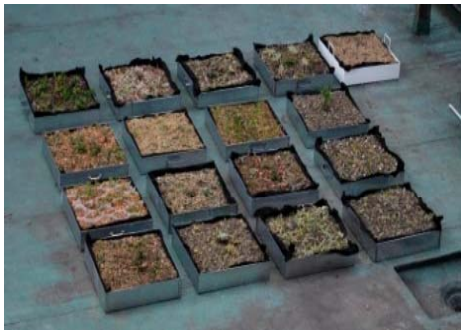
RESEARCH

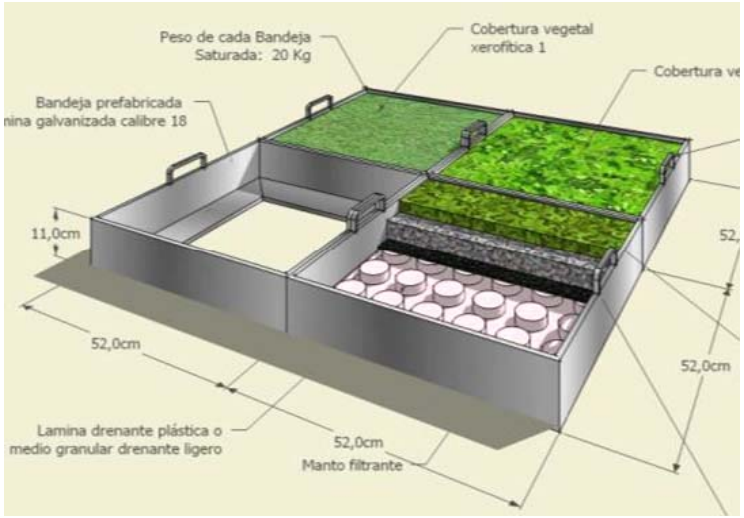


Green Roof / Wall

R E S E A R C H

Measurements on local climate





Green Roof / Wall

Global Construction Technologies & Building Materials

Grand Hyatt, Beijing, China

6th & 7th April 2009

Evaluating cost and benefit analysis of green building materials and construction technologies for better implementation and return on investment

Prof. Stephen S.Y. Lau

Member, China GBC

LEED Accredited Professional

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Honorary Professor, Tongji University,

South East University, Wuhan University

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A Study of Innovative, aesthetically pleasing and sustainable-oriented building façade and envelope technologies to gain a competitive edge

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Email: ssylau@hku.hk

November 06, 2008 HKU

THE MICRO - CLIMATIC IMPACT OF GREENERY IN HIGH RISE URBAN BUILT ENVIRONMENT

- USING SITE MEASUREMENTS AND SKY VIEW IMAGE PROCESSING TECHNIQUES

Feng YANG

Stephen S.Y. LAU

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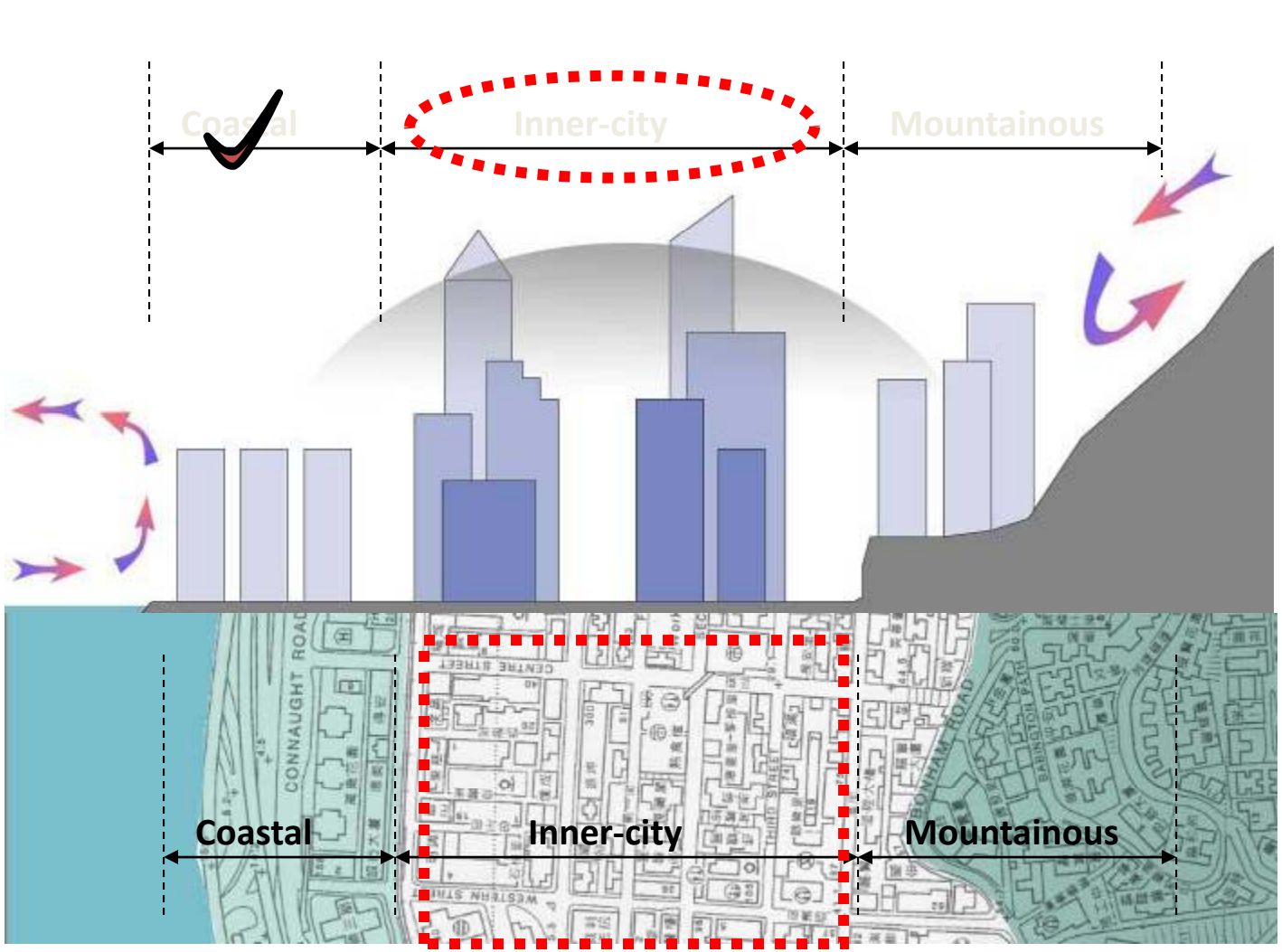

Classification of Hong Kong's Urban Heat Island

Thank you!

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  October 2003, Kats, G.
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- http://www.simonfieldhouse.com/Hong_Kong_Skyline_Simon_Fieldhouse_small.jpg